

Notice of Allowability

Application No.

10/607,141

Examiner

Jeffrie R. Lund

Applicant(s)

LOMBARDI ET AL.

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1763

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to election filed March 25, 2005.
2. ☒ The allowed claim(s) is/are 1-16.
3. ☒ The drawings filed on 26 June 2003 are accepted by the Examiner.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☐ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO-1449 or PTO/SB/08);
Paper No./Mail Date 10/6/03
4. ☐ Examiner's Comment Regarding Requirement for Deposit
of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☒ Interview Summary (PTO-413),
Paper No./Mail Date _____.
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

EXAMINER'S AMENDMENT

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Joseph Jordan on June 10, 2005.

The application has been amended as follows:

The claims have been amended to read:

1. (Currently amended) A method of maintaining processing pressure in a single-wafer vacuum processing chamber of a semiconductor wafer PVD processing machine having a plurality of processing chambers, and an a common exhaust volume communicating with each of the chambers and a high vacuum pump, the method comprising:

providing one of the chambers of the machine with a replaceable protective shield set configured to substantially protect, from deposition caused by a process in ~~said~~ the chamber, the walls of ~~said~~ the chamber and ~~of~~ a gas flow conductance path that extends from ~~said~~ the chamber to the exhaust volume, and the protective shield set configured to partially impede gas flow from ~~said~~ the chamber through the gas flow conductance path to the exhaust volume such that the processing pressure of gas in ~~said~~ the chamber is distinctly higher than the pressure in the exhaust volume.

2. (Currently amended) The method of claim 1 further comprising:

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controlling the flow of processing gas into said the chamber so as to maintain the processing pressure in the chamber.

3. (original) The method of claim 1 further comprising:

providing a controller programmed to control the processing of wafers in the chamber, including controlling the supply of processing gas into the chamber such that gas flows from the chamber, through the path and to the exhaust volume, and such that the processing pressure in the chamber is distinctly higher than the pressure in the exhaust volume.

4. (Currently amended) The method of claim 1 wherein said the chamber is a first one of the chambers and the method further comprises:

controlling the flow of processing gas into the first one of the chambers and of processing gas into a second one of the chambers so as to maintain the processing pressure of gas in the first one of the chambers at a pressure that is distinctly higher than the pressure in the second one of the chambers and in the exhaust volume, and so that the pressure in the second one of the chambers is higher than the pressure in the exhaust volume.

5. (Currently amended) The method of claim 4 further comprising:

providing the second one of the chambers of the machine with a replaceable protective shield set configured to substantially protect, from deposition caused by a process in said second one of the chambers, the walls thereof and of a gas flow conductance path that extends therefrom to the exhaust volume, and to partially impede gas flow from said second one of the chambers through its respective gas flow

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conductance path to the exhaust volume to a degree less than the gas flow is impeded through its respective path from said first one of the chambers to the exhaust volume, such that the processing pressure of gas in said second one of the chambers is distinctly higher than the pressure in the exhaust volume.

6. (Currently amended) The method of claim 1 further comprising:

providing a the semiconductor wafer processing machine with a having the plurality of single-wafer processing chambers, ~~a high vacuum pump, and the at least one exhaust volume communicating with the high vacuum pump.~~

7. (Currently amended) The method of claim 1 further comprising:

providing each of at least two of the chambers with a gas flow conductance path to the exhaust volume, at least one of which chambers being provided with the replaceable protective shield set; and

providing the controller programmed to control the processing of wafers in the chambers by controlling the supply of process gas into each of said two of the chambers such that gas flows from the chamber, through the respective path and to the exhaust volume, and such that a chamber that is provided with said shield set is maintained at a higher controlled processing pressure than another of said at least two chambers.

8. (Currently amended) The method of claim 1 further comprising:

providing each of at least two of the chambers with a replaceable protective shield set configured to partially restrict the flow from the chamber through a gas flow conductance path to the exhaust volume;

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one of said two chambers being configured for performance of a relatively high pressure process on a wafer therein and being provided with a shield set configured to provide relatively low gas flow conductance through its respective path, and the other of said two chambers being configured for the performance of a relatively low pressure process therein and being provided with a shield set configured to provide relatively high gas flow conductance through its respective path.

9. (Currently amended) The method of claim 1 further comprising:

providing each of at least three of the chambers with a replaceable protective shield set configured to partially restrict the flow from the chamber through a gas flow conductance path to the exhaust volume;

a first one of said three chambers being configured for performance of a relatively high pressure process on a wafer therein and being provided with a first shield set configured to provide relatively low gas flow conductance through its respective path;

a second one of said three chambers being configured for the performance of a relatively low pressure process therein and being provided with a second shield set configured to provide relatively high gas flow conductance through its respective path;

a third one of said three chambers being provided with either the first or the second shield set; and

providing the controller programmed to control the processing of wafers in the chambers, including controlling the supply of process gas into each of said three chambers such that processing pressure in the first one of the chambers is distinctly

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higher than the processing pressure in the second of said chambers and the exhaust volume, the pressure in the third one of the chambers is distinctly different than in either the first or the second ones of the chambers and the pressures in the second and third one of the chambers are distinctly higher than the pressure in the exhaust volume.

10. (Currently amended) The method of claim 1 further comprising:

providing each of at least two of the chambers with a gas flow conductance path to the exhaust volume;

providing each of said at least two of the chambers with a replaceable protective shield set configured to substantially protect walls of the chamber and the gas flow conductance path from deposition from the chamber, and to partially impede the gas flow from the respective chamber through the respective gas flow conductance path to the exhaust volume; and

providing ~~the~~ a controller programmed to control the processing of wafers in the chambers by controlling the supply of process gas into each of said two of the chambers such that gas flows from the chamber, through the respective path and to the exhaust volume, and such that each chamber is maintained at a different controlled processing pressure that is higher than the pressure at the exhaust volume.

11. (Currently amended) The method of claim 1 further comprising:

providing each of at least two of the chambers with a gas flow conductance path to the exhaust volume;

providing each of said at least two of the chambers with a replaceable protective shield set configured to substantially protect walls of the chamber and the gas flow

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conductance path from deposition from the chamber, and to partially impede the gas flow from the respective chamber through the respective gas flow conductance path to the exhaust volume, the shield set of the at least two chambers being differently configured to differently impede the gas flow from the respective chamber.

12. (Currently amended) The method of claim 1 wherein:

the providing of the protective shield set includes providing a nested set of shields including an outer shield adjacent the walls of the chamber and having an opening therethrough communicating with the gas flow conductance path, and an inner shield spaced from the outer shield so as to form an annular gap between the inner and outer shields that communicates with the opening, the gap and the opening forming a passage from the chamber to the gas flow conductance path.

13. (Currently amended) The method of claim 1 wherein:

the providing of the protective shield set includes providing a nested set of shields that includes an outer shield adjacent the walls of the chamber that provides line-of-sight protection of walls of the chamber from deposition from the chamber and having an opening therethrough communicating with the gas flow conductance path, and an inner shield spaced from the outer shield so as to form an annular gap between the inner and outer shields that communicates with the opening and so as to require at least three specular reflections off shield surfaces of atoms of coating material moving from the chamber to the opening.

14. (Currently amended) The method of claim 1 further comprising:

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injecting a flow of processing gas into said chamber through a hole in the shield set.

15. (Currently amended) The method of claim 1 further comprising:

injecting a flow of processing gas into said chamber through a hole in the shield set; and

sensing pressure in said chamber through a hole in the shield set.

16. (Currently amended) The method of claim 1 wherein the replaceable protective shield set comprises ~~includes a set of shields comprising:~~

an outer shield having a generally cylindrical portion and a gas outlet opening therethrough and a gas inlet opening therethrough;

an inner shield having a generally cylindrical portion of a diameter less than that of the generally cylindrical portion of the outer shield and having an inlet opening therethrough for alignment with the inlet opening of the outer shield; and

the inner shield being configured to mount in a nested relationship with the outer shield so as to form an annular gap between the inner and outer shields that communicates with the outlet opening and that extends sufficiently from the outlet opening so as to require at least three specular reflections off shield surfaces of atoms of coating material moving from the chamber to the outlet opening when the shield set is installed in a process chamber and a PVD process is being performed in the process chamber.

2. The following is an examiner's statement of reasons for allowance: The method of maintaining processing pressure in a single-wafer PVD processing chamber of a

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semiconductor wafer processing machine having a plurality of PVD processing chambers, and a common exhaust volume communicating with each of the chambers, specifically, the step of providing one of the chambers of the machine with a replaceable protective shield, comprising an inner and outer shield, configured to substantially protect, the walls of the chamber and the gas flow conductance path that extends from the chamber to the exhaust volume, and to partially impede gas flow from the chamber through the gas flow conductance path to the exhaust volume such that the processing pressure of gas in the chamber is distinctly higher than the pressure in the exhaust volume was found in or suggest by the art.

The prior art teaches one and two part shields that protect the walls and sometimes gas outlet connected to a vacuum pump. No prior art was found that taught or suggested:

- a. a multi-chamber PVD machine having a plurality of processing chambers connected to a common exhaust volume via a gas flow conductance path and a shield set;
- b. that the shield protects both the wall and conductance path; or
- c. that the shield impedes the gas flow from the chamber through the gas conductance path such that the processing pressure of gas in the chamber is distinctly higher than the pressure in the exhaust volume.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on

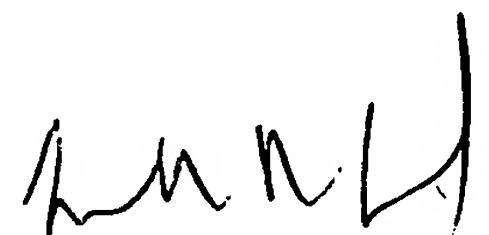
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Statement of Reasons for Allowance."

3. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jeffrie R. Lund whose telephone number is (571) 272-1437. The examiner can normally be reached on Monday-Thursday (6:30 am-6:00pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571) 272-1435. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Jeffrie R. Lund
Primary Examiner
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JRL
4/10/05